

LETTERS TO THE EDITOR

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[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.]

Meteors

HERE, November has generally been unpropitious for astronomical observations. However, during favourable intervals I have seen many brilliant meteors; from twenty to thirty on an average every night. They were principally seen with the face to the north, and glancing from shoulder to shoulder; but not a single Andromede did I see. I had the pleasure of seeing altogether about a score of Leonids before the 12th and after the 19th November. Leo Minorids and Arietids were plentiful, and a goodly number of Geminids were seen; but the richest field for meteors during the month was in the neighbourhood of the Plough. November 6, at 4.30 a.m., a large meteor passed from γ Ursæ Majoris right down to the horizon. From 4.35 to 5.15 three veritable Leonids proceeded from the Sickle; one dashed down to the right-hand, and another from the top of the Sickle to the left over the Lion's back. They were very large. November 10, at 8 p.m., a brilliant meteor started from a point nearly half way between Aldebaran and Saturn, and disappeared at a point down more than half way to the horizon. At 9.30 a very bright one appeared at a point about 1° above Castor and above Jupiter to the north. At 11.25 an exceedingly large and brilliant meteor burst out from $\frac{1}{2}^{\circ}$ below Menkar (in the Whale), and went down at right angles to the very horizon, leaving a long, bright streak behind. November 11, a large one, at 0.15 a.m., dropped down to the horizon from θ Ursæ Majoris. At 0.55 a.m. a very large one proceeded from $\frac{1}{2}^{\circ}$ to the right of α Lacertæ and disappeared at γ Cygni. November 18, at 1.40 a.m., a very large reddish meteor burst out from the top of Ursa Major's head, and passed right above Vega, and disappeared about 4° beyond it in a strange sparkling explosion. At 1.55 a.m. a very brilliant meteor dashed out about 2° above α Arietis, went through the Square of Pegasus, leaving a beautiful stream of blue fire behind, and lasting a few seconds. About 5.30 another large blue meteor passed from the centre of Leo's back through a point 4° above Denebola, and ended in a beautiful explosion 15° beyond. On the night of November 22 there was a fine display of (generally) large meteors from Taurus to Ursa Major; many of them proceeded from the Lion's Head. During the month a great number of meteors passed from some point in Scorpio, under Jupiter and Mars, right into the Lion's Head. They were all large and bright. During the last half of the month some fine displays of morning meteors were seen. At 4 a.m., November 29, I observed a very large and swift meteor. It blazed out from a point about 8° above Denebola, and dashed with great velocity up the heavens, passing 4° above δ Leonis and over the Lion's Head, and exploded about 5° beyond, leaving a stream of the most beautiful blue light in its wake that I ever witnessed.

DONALD CAMERON

Mossvale, Paisley, December 3

As your columns frequently contain notices of meteors, I may mention that I observed one of unusual brilliancy last night (November 28) at 10.50. It appeared in the constellation Taurus, and, following the line of the ecliptic, disappeared about five to ten degrees above the eastern horizon. The meteor was visible for not less than fifteen seconds, had a brilliant train or cone of light of from two to three degrees in length, and outshone Jupiter, near which it passed. From the slow, angular movement of the meteor I feel certain that the train was not an optical impression, but a real luminous object.

F.R.S.E.

Edinburgh, November 29

A FINE meteor was observed here by me at 10h. 38m. last night, Wednesday, November 28. Bursting into sight near η Ursæ Majoris, it passed in a course almost parallel to, but about 2° north of, a line joining α , δ , ϵ , ζ , and η Ursæ Maj., its light expiring near λ Boötis. Length of path = 40° . No train was observed; the only variation of uniformity of light being at

about half way of its passage, where it slightly faded for an instant and then as quickly recovered. Duration about four seconds. Brilliance three or four times Venus at its brightest. Colour resembled that of magnesium light.

W. WICKHAM
Radcliffe Observatory, Oxford, November 29

LAST night, about 10.30, I saw a magnificent bolide shoot across the sky in a northerly direction. It came from the middle star in Orion's belt, and disappeared at a point almost in a line with "the Pointers" in the Great Bear, and at a distance below the lower of the two stars almost equal to the distance between them. Its path was perceptibly arched, but not to any great extent, and, as far as I could judge, it was not parabolic. When the bolide first appeared, it seemed a mere luminous point moving with great rapidity, and without a tail. But about half way it suddenly grew large and brilliant, a tail shot out, and the path behind it remained luminous and distinct. I could compare the bolide at this point to nothing so much as to a red-hot cannon ball emitting sparks of fire. It was accompanied by no sound, and was gone in half a dozen seconds. During its passage the streets seemed to be lit up with the electric light. It was apparently so close that I should think a few miles would have made a very sensible difference in its apparent position in the heavens.

J. E. OLDHAM
Stockport, November 29

LAST night at 11h. 2m. I saw in the north-west, near the horizon, one of those slow-moving balls of fire, not so bright as an ordinary meteor, and leaving no train. This seemed the size of a cricket ball; but I have seen one the size of a cheese-plate. A few flashes of lightning occurred soon after. From the slowness of the motion the phenomenon seemed to be wholly atmospheric. It was in sight for about three or four seconds. It instantly suggested an incandescent vortex whorl; but I cannot say whether the appearance confirmed the idea or not, for I do not know how such a meteor would look. Its red light might be due to its proximity to the horizon, perhaps 8° . Hence there is no dependence to be placed upon my impression that the light was the result of friction rather than of electricity. I have seen probably a dozen in the course of my life, always in the west or north-west, and always about the same height from the horizon, but never annular.

HENRY H. HIGGINS

Rainhill, December 4

"Anatomy for Artists"

MAY I add a few more words on the subject of Mr. Marshall's book, and in answer to his letter in NATURE? Mr. Marshall says the reasons that led him to adopt the plan of omitting reference letters to his illustrations of the bones "will remain sound." Turning to p. 30 of the book to learn those reasons, I find he says that "The numerous minute points which demand the attention of the anatomist and the surgeon necessitate such aids; but the art-student's mind should be left unencumbered by such unnecessary details."

I cannot see that this is a reason; I wanted references to what is described in the text—to the necessary, not the unnecessary details.

Secondly, Mr. Marshall says, "The pure form of the bones, represented on so small a scale, in black and white, would have been seriously marred by such references." If this be "sound," may there not be more and equally sound reasons for opposing it? I think there are; and if Mr. Marshall will turn to p. 136 of the book, I will try to show him how his plan works. The student reads there that "All the bones of the hand are visible in the skeleton, on its palmar aspect (Fig. 58), carpal, metacarpal, and phalangeal;" he turns to Fig. 58, but where is it? It is mentioned in a list of figures under three illustrations. He has to make up his mind which of the three is 58, recalls that it is the palmar aspect, and goes on. He has no clue, let Mr. Marshall observe, by which to know which are the carpal, metacarpal, and phalangeal portions of the hand for which he originally looked at the palmar aspect of it. He hopes he may come to that; and, reading on, finds that the eight carpal bones are "in the carpus;" but then, which is the carpus? He does not know, and is not told. Never mind, he thinks, he will find that out by the description of the single bones, and, beginning with the first-mentioned, he reads that the semi-lunar bone ". . . . occupies the centre of the first row, and is crescentic

in shape." Looking again at the illustration, for "rows" he finds that the bones which seem to be arranged in rows are those which he may afterwards learn to be the metacarpals and phalanges. Supposing, however, that he guesses the carpus rightly, which of its bones is semi-lunar or crescentic in shape? I think if the picture were put before *any* ordinary observer, told to point out a crescentic bone, he would select the scaphoid. There is, then, the student, still a clue left, for the semi-lunar "occupies the centre of the first row." But the first row contains *four* bones; at least he has read that "the eight bones are clustered together so as to form two groups," and he is not told that these groups are not the "rows" afterwards mentioned. He gives it up, and reads the other bones to learn them and find the semi-lunar by the exhaustive process. The guide he finds to the cuneiform bone is that it is "on the ulnar side of the semi-lunar," which he has perhaps failed to guess rightly, and articulates with certain other bones, which are to be afterwards described, and are unknown to him; and so on.

The mode of progression is like that I made once in Ireland, when on asking a peasant my way I was told to take the last turning before coming to the next milestone. There were a good many steps to retrace after finding the next milestone.

I have no doubt at all of the moral influence of Mr. Marshall's plan *if the student perseveres in using his book*; he will have exercised patience, attention, command of temper, and careful criticism of words, but I do not think his anatomical will equal his moral gain.

The process described above simply distracts the student's attention from the form of what he is studying. Would Mr. Marshall wish the Map of England taught in the same manner—no names or references given to the counties, and Hampshire to be recognised because it is in the last row and adjoins certain other counties, which in their turn adjoin it?

ART STUDENT

Barytes from Chirbury

I HAVE to thank Mr. Woodward for pointing out that the plane (412) has been established for barytes. It was first given by Helmhacker (*Denksch. der K. Akad. der Wiss. Wien*, vol. xxxii, 1872) as occurring on crystals from Svárov and Krušná hora in Bohemia, but is rejected by Schrauf as insufficiently determined. The distinguishing peculiarities of the Chirbury crystals are (1) the predominance of the plane E which does not truncate an edge as is the case in Carl Urba's crystals; (2) the frequent occurrence of ω and ξ ; (3) the tendency of the face ω to develop small faces on its edges which are inclined to ω at angles near 3° . Such faces are Q and Y, and I have since determined a face A on the edge $\omega\mu$ with indices near (25, 1, 27).

British Museum, November 26

H. A. Miers

THE ORIGIN OF CORAL REEFS¹

II.

THE most detailed investigation of coral-reefs which has yet appeared has just been published by Prof. A. Agassiz.² This able naturalist is engaged in prosecuting a series of researches into the biological phenomena of the seas on the eastern side of the United States, under the auspices of the United States Coast Survey, and in the course of these explorations he has had occasion to devote himself to the detailed study of the coral-reefs of the Florida seas. For purposes of comparison he has likewise visited the reefs among the West Indian Islands, as well as those on the coast of Central America. His observations are thus the most exhaustive and methodical which have yet been published, and the deliberate conclusions to which he has come deserve the most attentive consideration. He traces the history of a coral-reef from its latest stages as dry land to its earliest beginnings, and even beyond these to the gradual evolution of the conditions requisite for the first starting of the reef. His familiarity with the nature of the bottom all over the area in question, and with the life so abundant in the tropical waters, gives him

a peculiar advantage in this inquiry. The upheaval of recent coral-formations to considerable heights above the sea in various parts of the region enabled him to examine the inner structure and foundations of the reefs, and to obtain therefrom altogether new data for the solution of the problem. Following him in his induction we are led back to a comparatively recent geological period, when the site of the peninsula of Florida was gradually upraised into a long swell or ridge, having its axis in a general north and south direction, sinking gently towards the south, but prolonged under the sea as a submarine ridge. The date of this elevation is approximately fixed by the fact that the Vicksburg limestone was upraised by it, and this limestone is assigned to the Upper Eocene series. As a consequence of the elevation, a portion of the seabottom was brought well up into the waters of the Gulf Stream, which were probably shifted a little eastward.

No marine fauna yet explored equals in variety of forms or number of individuals that which peoples the waters of the Caribbean Sea and the Gulf of Mexico from the depth of 250 to about 1000 fathoms. This prolific life is traced by Prof. Agassiz to the copious food-supply carried by the warm tropical currents, combined with the food borne outwards from the sea-board of the continent. The corresponding abundant fauna found by the *Challenger* in the Japanese current may be regarded as its counterpart in the Pacific Ocean. Prof. Agassiz points also to the diminished richness of the fauna on the western side of the continents as being probably connected with the absence of those warm equatorial currents which bring such an abundant supply of food to the eastern shores. "No one," he remarks, "who has not dredged near the hundred-fathom line on the west coast of the great Florida Plateau can form any idea of the amount of animal life which can be sustained upon a small area, under suitable conditions of existence. It was no uncommon thing for us to bring up in the trawl or dredge large fragments of the modern limestone, now in process of formation, consisting of the dead carcasses of the very species now living on the top of this recent limestone." Mollusks, echinoderms, corals, alcyonids, annelids, crustacea, and the like, flourish in incredible abundance on the great submarine banks and plateaux, and cover them with a growing sheet of limestone, which spreads over many thousands of square miles and may be hundreds of feet in thickness. In these comparatively shallow waters, and with such a prodigiously prolific fauna which supplies constant additions to the calcareous deposit, the solvent action of the carbonic acid upon the dead calcareous organisms is no doubt reduced to a minimum, so that the growth of the limestone is probably more rapid than on almost any other portion of the seabottom.

From the charts we learn how extensively submarine banks are developed in the West Indian region in the track of the warm currents. East of the Mosquito Coast, in Central America, one of these banks may be said to stretch completely across to Jamaica. Similar banks rise off the Yucatan coast; likewise on the windward side of the islands, where the ocean currents first reach them.

That these banks lie upon volcanic ridges and peaks can hardly be doubted, though we have no means of telling what depth of recent limestone may have accumulated upon them. Among the islands, recent volcanic masses rise high above sea-level, in Martinique reaching a height of more than 4000 feet. And as usual in volcanic regions there are numerous proofs of recent upheaval, such as the Basse Terre of Guadalupe, the successive terraces of recent limestone in Barbadoes, and the upraised coral-reefs of Cuba, which lie at a height of 1100 feet above sea-level.

The West Indian seas have long been famous for their coral-reefs. Prof. Agassiz insists that the distribution of these reefs is determined by the direction of the food-

¹ Continued from p. 110.

² "On the Tortugas and Florida Reefs," *Trans. Amer. Acad.* xi. (1883).